DOE Transmission Reliability Research Review

DER Support for a Reliable Electric Grid in a Competitive Market

Margie Tatro

Sandia National Laboratories

Representing the research team of:

LBNL, ORNL, PNNL, SNL

Southern California Edison & Electric Power Group

University of Wisconsin & Georgia Institute of Technology

December 10, 2002

CERTS

CONSORTIUM FOR ELECTRIC RELIABILITY TECHNOLOGY SOLUTIONS

The Goal – Achieve Full Benefits and Value for DER

- Technical Standards
- System Integration R&D – work to date within the Transmission Reliability Program supports this element of the Distributed Power Program
  - Enabling tools for DER integration
  - Preparing to demonstrate functionality of concept
  - Engaging partners to complement DOE resources
- Regulatory and Institutional Barriers

Our goal today is to show how the transition in FY03 supports DOE's mission objectives in DER areas.

CERTS
CONSORTIUM FOR ELECTRIC RELIABILITY TECHNOLOGY SOLUTIONS

Project Value - The Research Goal is as Follows…

Identify and develop system integration tools and techniques

to permit reliability-enhancing operation of

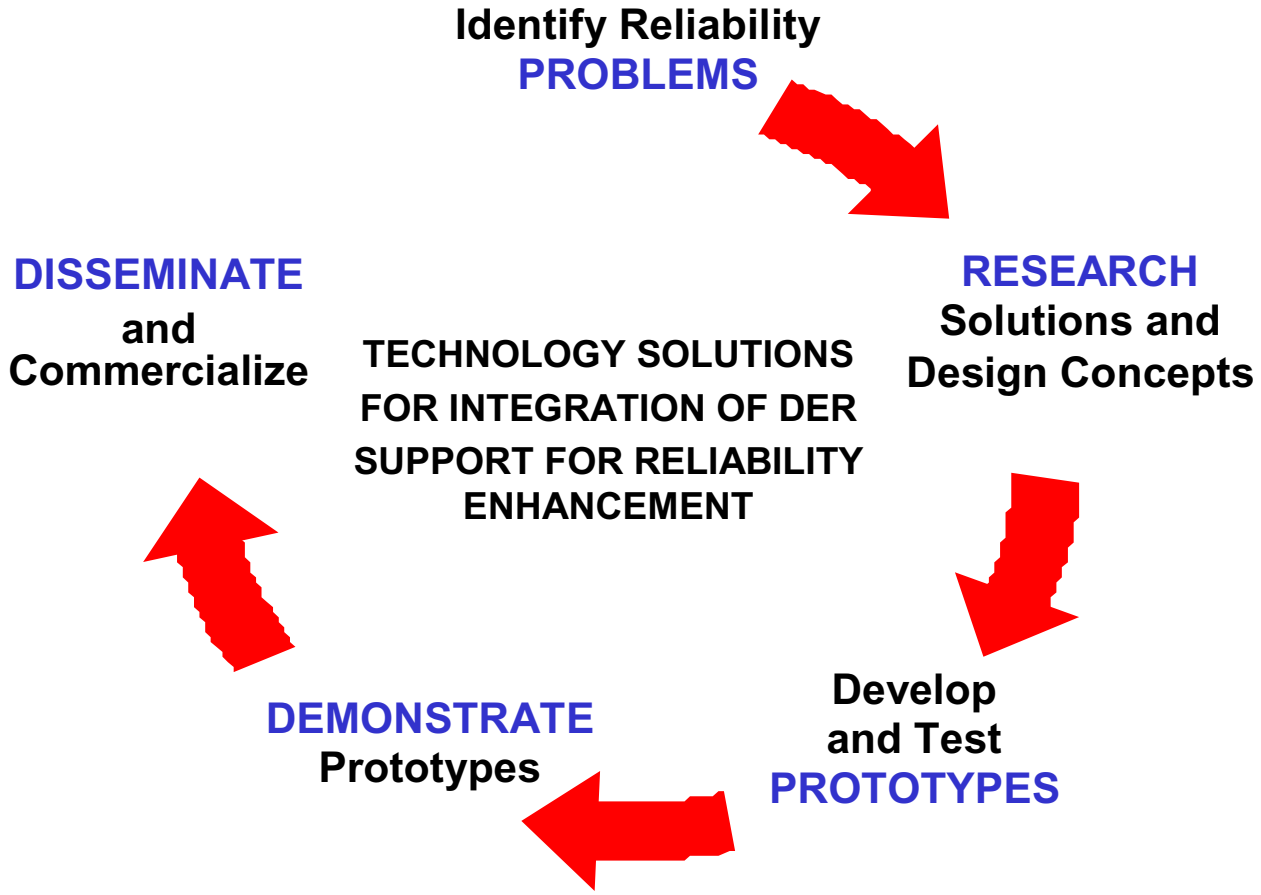
large numbers of

small (< 500 kW) distributed energy resources

in the distribution system.

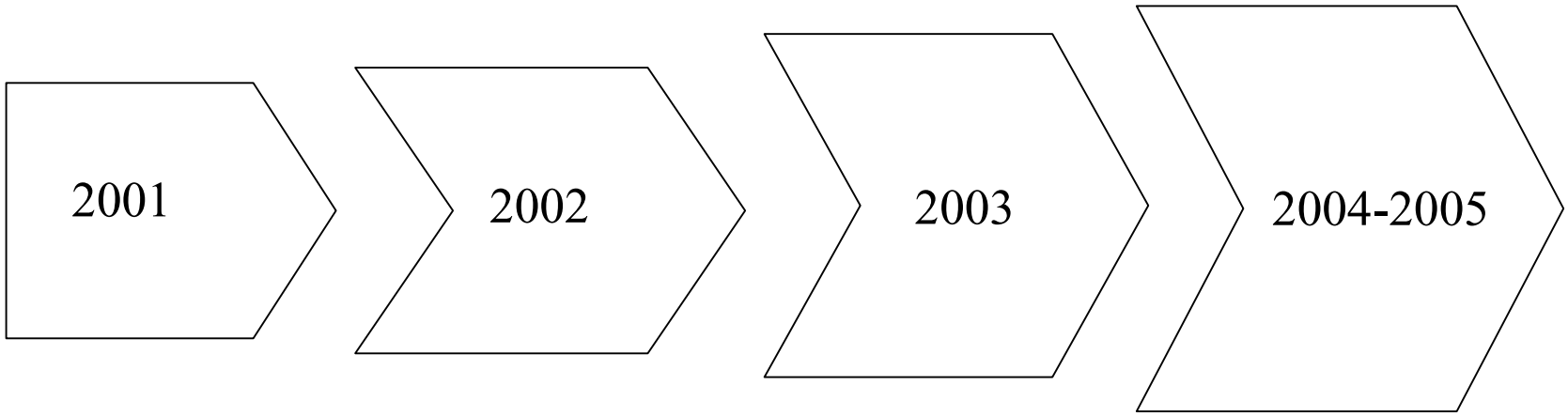
CERTS
CONSORTIUM FOR ELECTRIC RELIABILITY TECHNOLOGY SOLUTIONS

CERTS Reliability Technology Solutions Development Framework



CERTS
CONSORTIUM FOR ELECTRIC RELIABILITY TECHNOLOGY SOLUTIONS

The Approach is to Move from Concept to Realization



Validate integration concept. Conceive analysis tools.

Design protection and control concepts and prototype at component level. Complete business case analysis.

Detailed design of testbed. Selection of testbed site.

Implement protection and control concepts at demo site. Demonstrate at customer/power park level. Show transmission system impacts.

CERTS
CONSORTIUM FOR ELECTRIC RELIABILITY TECHNOLOGY SOLUTIONS

The Overall Plan

Research Roadmap

2001	CERTS Microgrid concept conceived, reviewed and vetted.
	Created new analysis tools and data for study of CERTS Microgrid
	Developed CERTS Microgrid control and protection concepts
2002	Implemented protection and control concepts at component level
	Defined CERTS Microgrid demonstration plan
2003	Implement CERTS Microgrid protection, controls, communications at site level
	Implement CERTS/CEC Microgrid demos at test site level
	Work with distribution utilities to determine protection/control issues at power parks
2004	Implement CERTS Microgrid demos at customer/power park level
2005	Coordinate CERTS Microgrid demos at several customer/power park sites (show transmission system impacts)

CERTS
CONSORTIUM FOR ELECTRIC RELIABILITY TECHNOLOGY SOLUTIONS

Role of the DOE Program

- Sponsor enabling research in basic science of Microgrids
- Develop tools which support the design and use of Microgrids as well as other DER applications
- Obtain partners from other governmental organizations, utilities, and industry to leverage the continued development and implementation of Microgrid concepts
- Transition the basic research performed to proof of concept test beds and eventually to commercialization in collaboration with these partners
- Address research issues that arise during implementation and commercialization of these concepts

CERTS
CONSORTIUM FOR ELECTRIC RELIABILITY TECHNOLOGY SOLUTIONS

Project Organization and Management System

- Management Steering Function – Margie Tatro (strategic direction) and John Boyes (implementation oversight)
- Program Office – Joe Eto (project coordination, DOE Program Manager interface, budget and milestone tracking, information management)
- Technical Leads – Bob Lasseter and John Stevens (CERTS Microgrid Project Manager)
- Research Performers – John Stevens (protection); John Kueck (energy manager); Bob Yinger (microturbine testing); Ross Guttromson (transmission system impacts); Sakis Meliopoulous (distribution system modeling); Chris Marnay (customer adoption model)
- Process – planning, internal reviews, external reviews

CERTS
CONSORTIUM FOR ELECTRIC RELIABILITY TECHNOLOGY SOLUTIONS

Past Accomplishments

Report Card

Funding: $2.8 million through FY02

Accomplishments

➢ Surveyed Test Locations and Implemented DER test bed at UC Irvine	2000
➢ Created Steady State & Dynamic Models of Loads & Micro-Sources	2000
➢ Developed (with CEC) prototype DER Customer Adoption Model	2000
➢ Developed Droop Controls for CERTS Microgrid	2001
➢ Characterized micro sources (microturbines)	2001
➢ Defined & vetted CERTS Microgrid Concept (12+ presentations)	2001
➢ Assessed status of existing modeling tools	2001
➢ Developed tool for multiphase power flow assessment	2001
➢ Developed strong relationships with partners: UCI, CEC, others	2000-2

http://certs.lbl.gov/DER_Integration.html

CERTS
CONSORTIUM FOR ELECTRIC RELIABILITY TECHNOLOGY SOLUTIONS

Four Activities Completed in FY02

FY02 Resources

- $500K

Key Projects/Deliverables

- Disseminated CERTS Microgrid design and began planning CERTS Microgrid demonstration projects (with partners)
  - Obtained California Energy Commission as funding partner for the Microgrid test bed
- Assessed business case for CERTS Microgrid (including combined heat and power)
- Developed conceptual control and protection schemes for CERTS Microgrid integration with grid of the future
- Developed and began commercialization of design tools

CERTS
CONSORTIUM FOR ELECTRIC RELIABILITY TECHNOLOGY SOLUTIONS

Partnership to Test the CERTS Microgrid Concept

- **Sponsor is CEC PIER; Partners under discussion:**
  - Capstone Microturbines, Northern Power Systems, others likely
  - 2 years: Demonstrate feasibility of functional concepts through tests at a "utility" test site – voltage control, protection, transition to island, etc.
  - 3 years: Build and operate a prototype CERTS Microgrid at a user site
- **Milestones and Schedule:**
  - Negotiated scope of work, schedule and cost for CERTS Microgrid demonstration with CEC (10/02).
  - Completed statement of work for testbed design and microturbine control modifications. Documented protective relaying requirements for testbed. (12/02)
  - Complete modifications to 3 Capstone machines (02/04)
  - Initiate testing at the test site (05/04)
  - Complete the demonstration of key control and protection issues at test site using the 3 modified Capstone machines (11/04)
- **CERTS Responsibilities:**
  - Define functional requirements for Capstone modifications, test facility requirements and test plan for test sites
  - Manage Capstone and testbed contracts

CERTS
CONSORTIUM FOR ELECTRIC RELIABILITY TECHNOLOGY SOLUTIONS

Partnerships Are Essential

Major Collaborators:

- California Energy Commission
- University of California, Irvine
- Northern Power Systems
- Capstone

Discussions:

- American Electric Power
- National Rural Electric Cooperative Association
- Others

Research Performers:

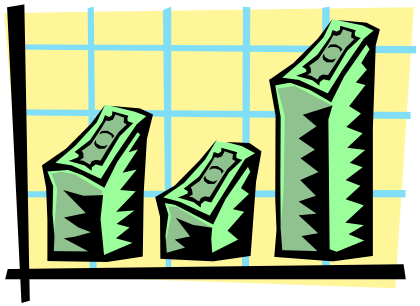
- 8 CERTS Organizations (see cover slide for listing)

Information Sharing:

- EPRI PEAC
- National Renewable Energy Laboratory

CERTS
CONSORTIUM FOR ELECTRIC RELIABILITY TECHNOLOGY SOLUTIONS

DOE has a Strong Collaborator – the California Energy Commission



	DOE	CEC
FY99	$ 800K	
FY00	$ 700K	
FY01	$ 750K	$ 500K
FY02	$ 500K	$ 250K
FY03	$ 500K	$ 1,100K*
TOTAL	$ 3,250K	$ 1,850K

*preparation for future test site activities

CERTS
CONSORTIUM FOR ELECTRIC RELIABILITY TECHNOLOGY SOLUTIONS